

21-3.

THE CEMENT GUN

...IN...

Building Construction

BULLETIN 114



Type N-1 Cement-Gun

Cement Gun Company, Inc.

Allentown, Penna.

U. S. A.



One of the many building of the Whitby Hospital for the Insane
being covered with "Guniting"

The same methods employed here can be used in the renovation and reconstruction of old brick or concrete buildings, with the exception that it will be advisable to first sandblast the building (using the Gun as a sandblast machine) in order to remove all loose or extraneous materials.

If it is desired to cover an old frame building with Guniting, this can be done by first tacking tar-paper over the building and then attaching with staples a light reinforcing mesh such as heavy poultry wire, in such a manner as to prevent the wire being placed directly against the paper, and then shooting the Guniting and proceeding as noted.

In placing Guniting over wood, marked attention must be paid to the advisability of covering the wood with a paper prior to attaching the reinforcing mesh, because otherwise, not only does the wood tend to absorb the moisture from the Guniting prior to its getting a set, but also the wood shrinks away from the Guniting as its accustomed moisture is excluded.

An illustration of this occurred recently in some buildings erected in Cuba. The owners called the Cement Gun Offices on the telephone and stated that they were not getting satisfactory results. Upon investigation, it was found that they had shot Guniting on sheathing made up of green lumber, and without paper covering, with the result that the boards were shrinking and cracking the Guniting.



Frame Dwelling renovated and made new with Gunitite



Gunite over Hollow Tile

However, the most satisfactory method of wall construction is obtained by attaching directly to the frame-work of the building, as illustrated above, (whether of truss or simpler construction) a reinforcing mesh of weight dependent on the span and thickness of the slab, and covering this with from three-quarter inch to two inches of Gunite. Care should be taken to see that the reinforcing mesh is furred away from the frame in order to insure its being entirely covered. Inasmuch as the theory of Gunite walls is based on the principle of reinforced concrete, the mesh should be near the inner side of the slab.



Hollow Tile House Completed

Two methods are employed in placing the Guniting slabs; either by standing a panel along the plane of the outer face of the wall and shooting the Guniting from the inner surface; or by attaching a tar paper of at least two-ply thickness to the frame, to act as a form, and shooting against this from the outside. If the latter method is used, and it is desired to obtain a wall of artistic finish, similar methods to those previously mentioned must be employed, but it should be noted that an experienced nozzleman can produce an excellent surface without the aid of a mason. The tar-paper serves the two-fold purpose of, at the same time providing a form for the Guniting, and aiding to keep the wall drier.

In work of this type, especial attention is called to three or four cardinal principles:

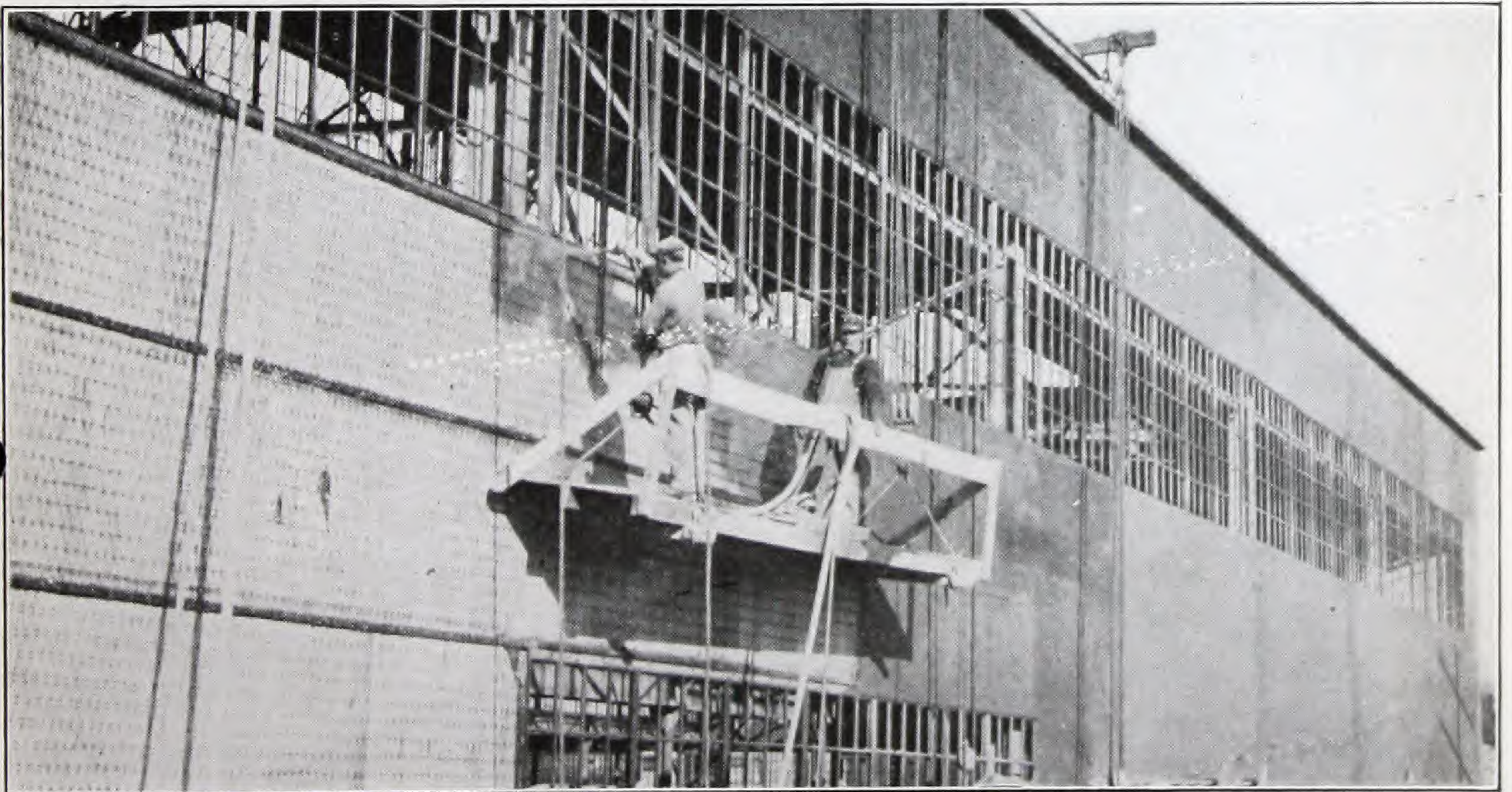
1st. The tar-paper must be drawn tight and firmly held.

2nd. The wiring must be drawn to as near a true plane as possible, and it is for this reason that light expanded metal offers a better method of reinforcing than any other. All reinforcement should be mesh of no less than one and one half inches.

3rd. The reinforcing mesh should never break at the corners, but should be carried around the corner in a sharp bend for at least one foot.

4th. The reinforcing mesh should always lap at least six inches.

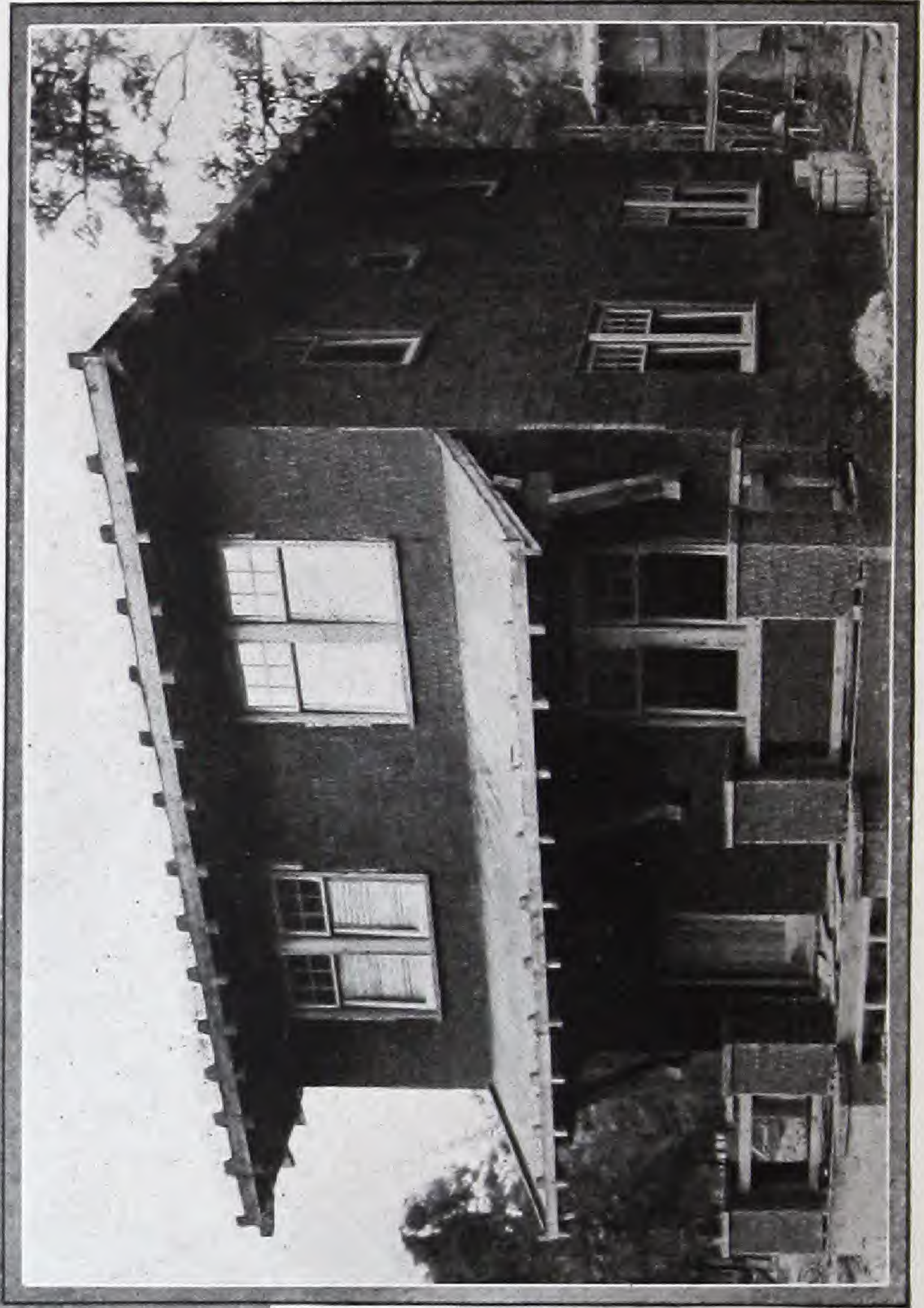
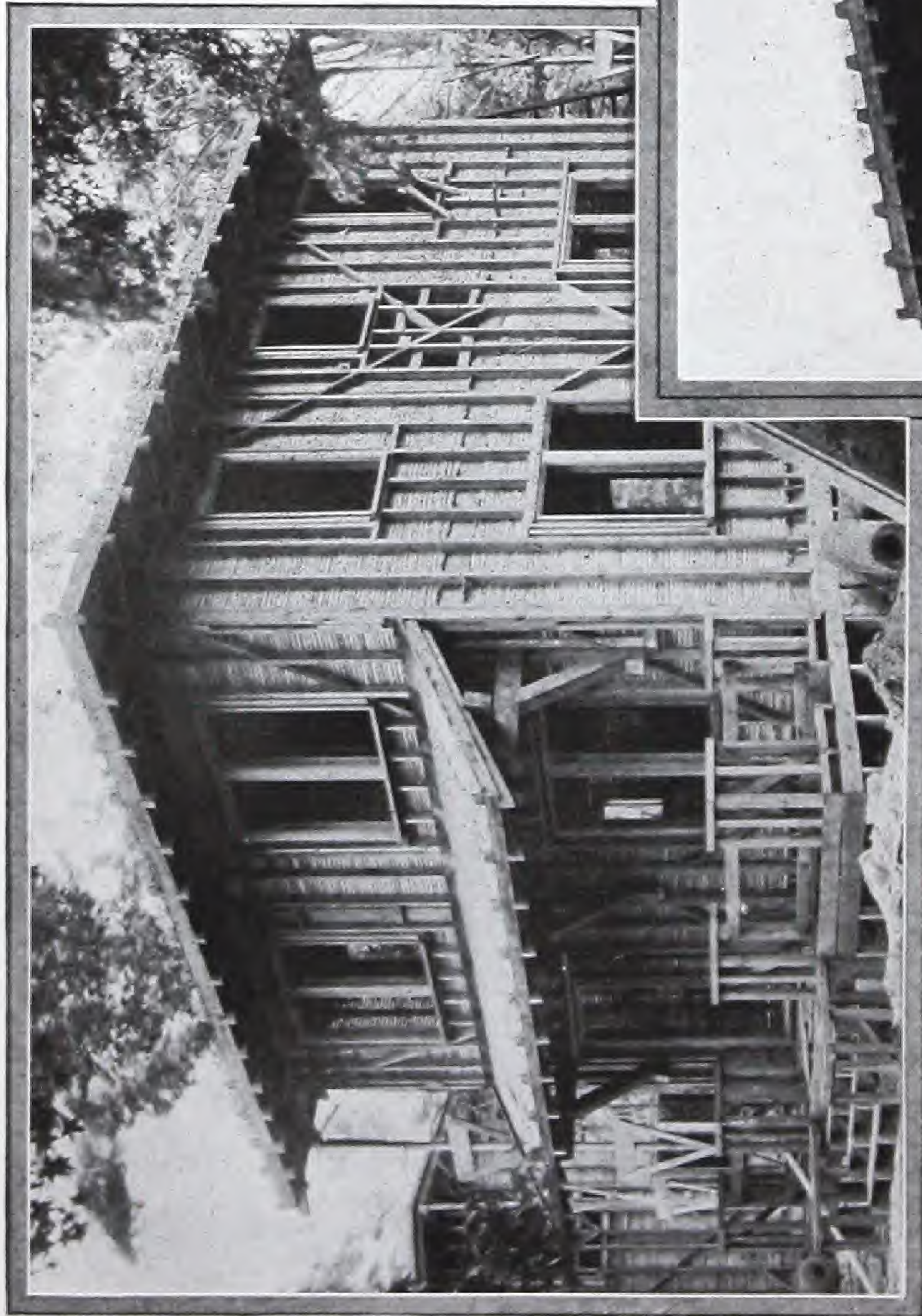
5th. The mesh should be doubled by the addition of a small strip under and over the corners of windows and doors. This is a precaution to insure against cracking at this weakened point.




Building Side Walls of Illinois Steel Co. Plant


Building Houses Over Fram

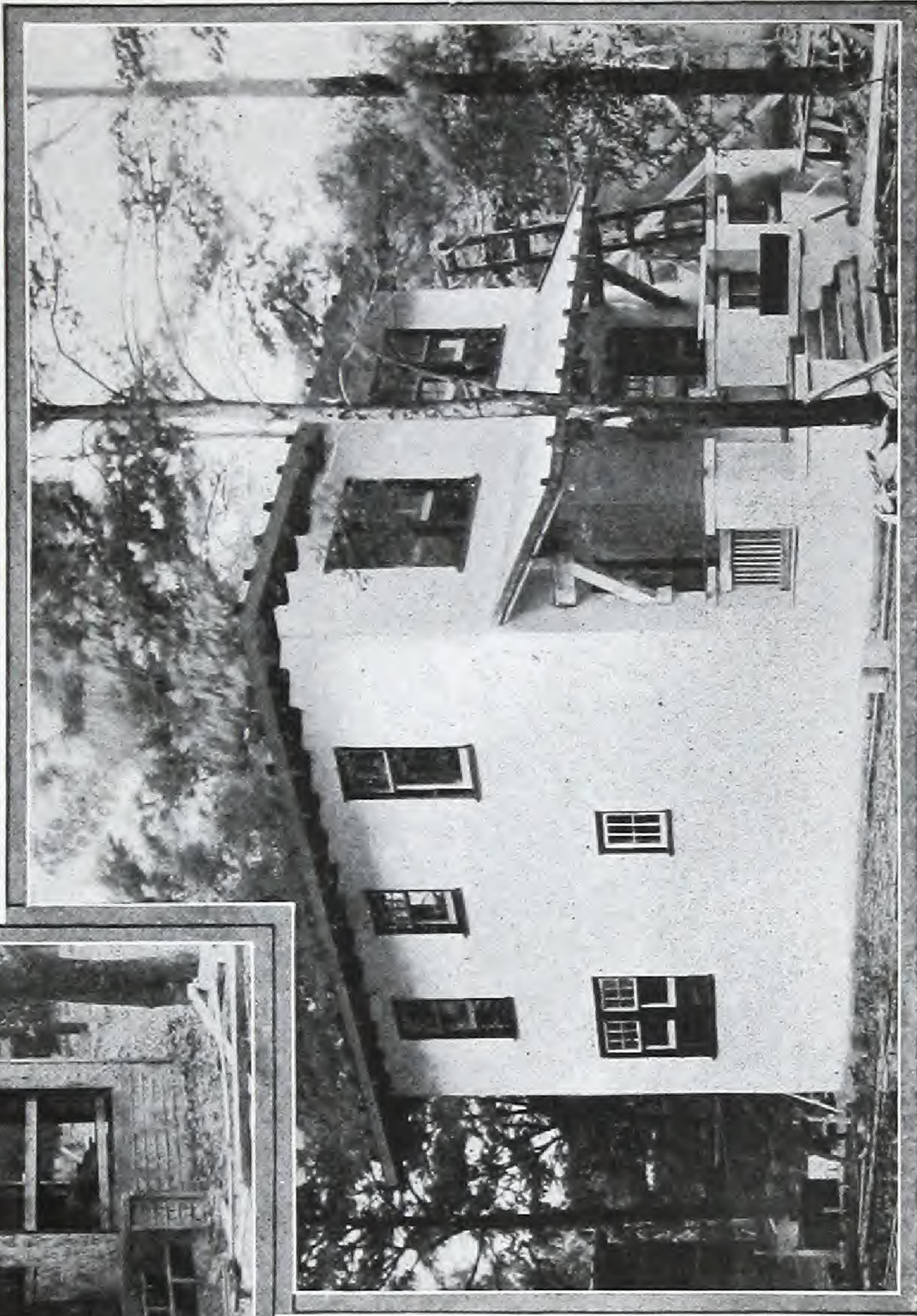
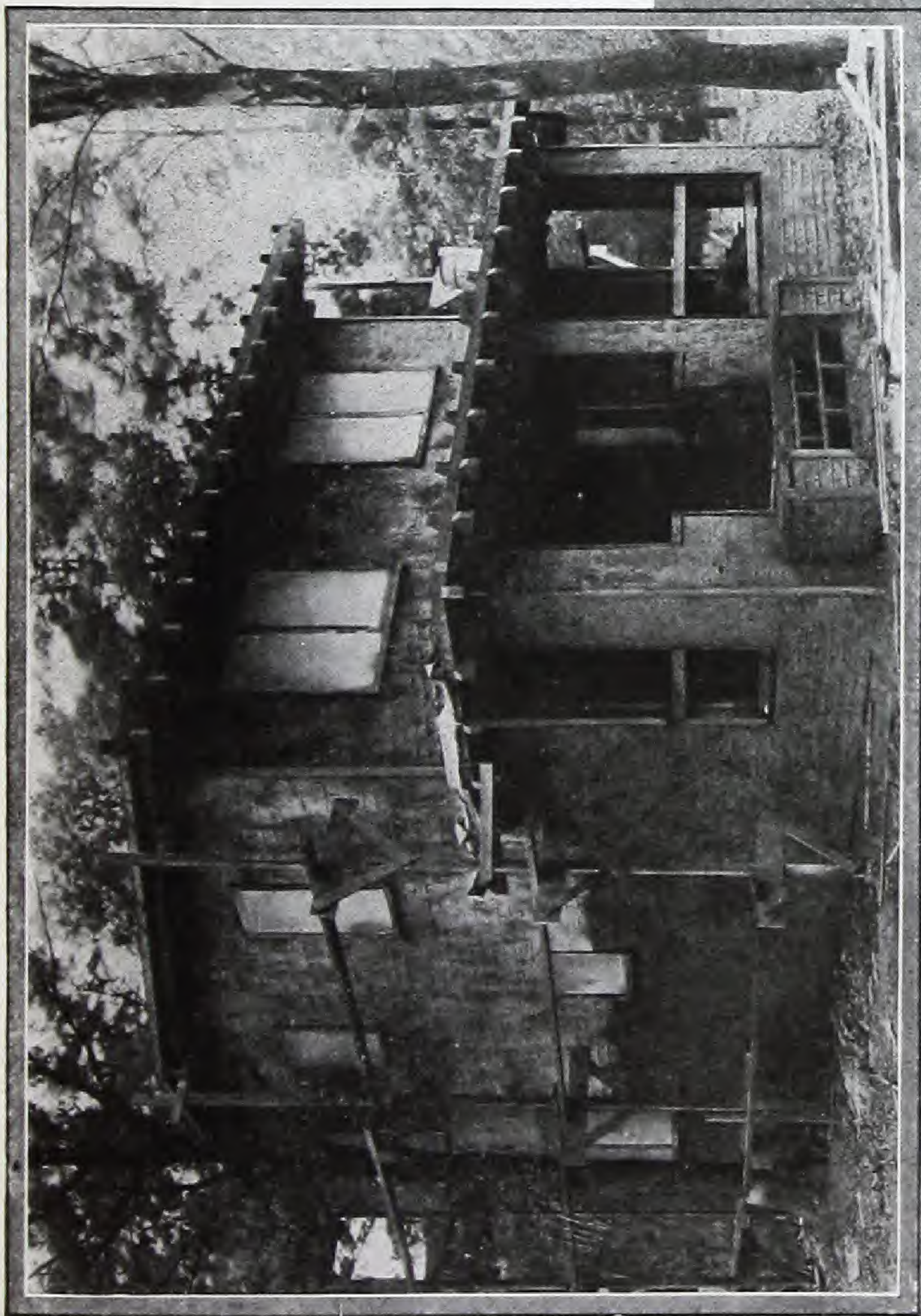
1st Stage



2nd Stage.  Tar paper and reinforcing mesh

ame Studding With Gunitite

 Rough coat of Gunitite



Finished Building 

Another matter that meets the careful consideration of builder; is the proportions in which the materials should be mixed.

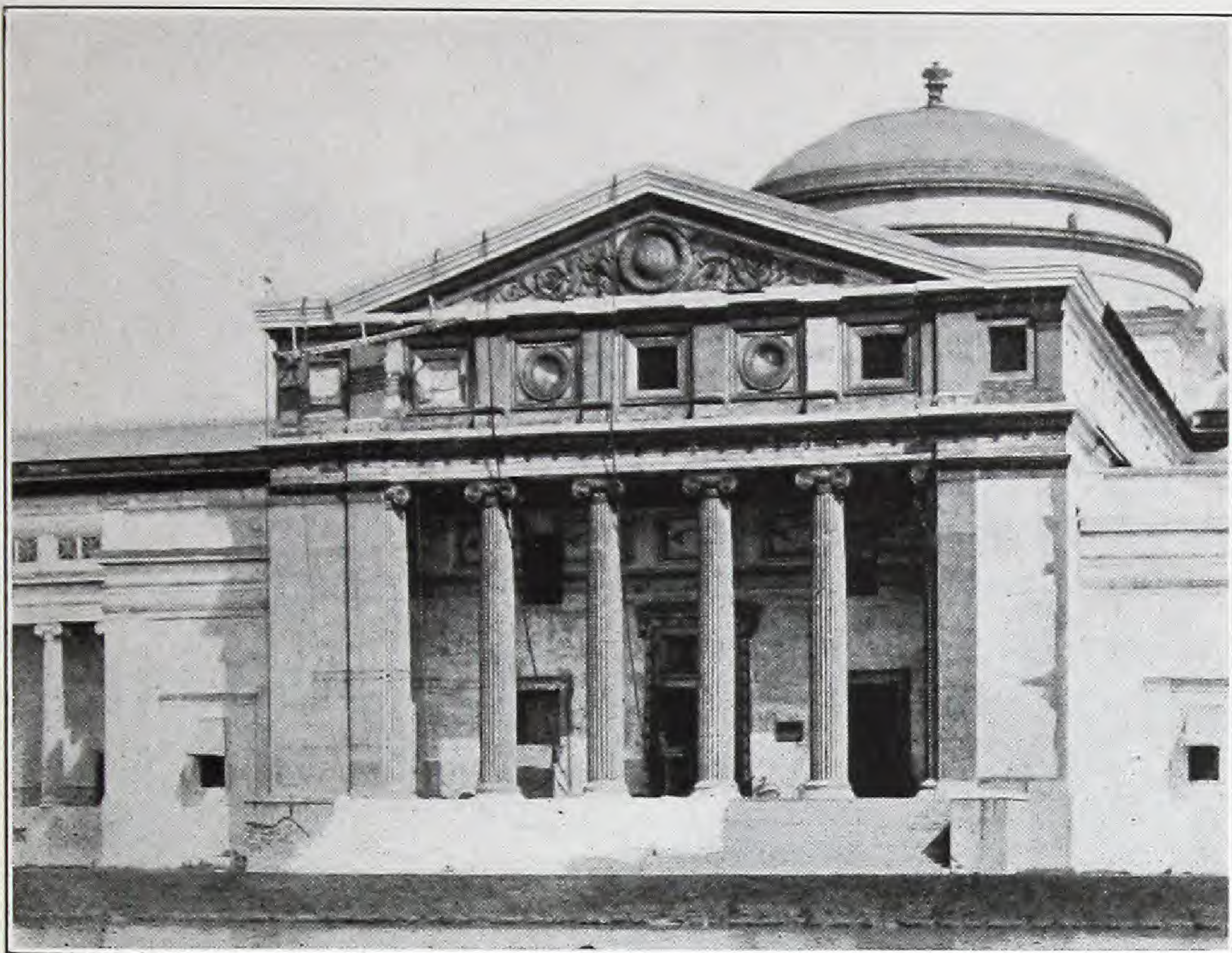
In Los Angeles, California, a firm of contractors who have specialized in Cement Gun work recommend the use of a mortar made up of one part cement and four parts sand with the addition of about ten percent of hydrated lime. They claim that in their climate they have obtained by this mix, walls that are freer from checking and cracking than by any other. In addition they use a small amount of hemp fibre (old rope in very short lengths) to each batch, claiming that thereby they aid against checking.



Gunitite over Expanded Metal and Tar Paper

At the Hospital for the Insane at Whitby, Ontario, the buildings have been covered with a mortar made by using one part of a mixture of 80% Alco (hydrated) lime, and twenty per-cent cement, with two parts of sand. Even in that cold climate they seem to have obtained excellent results with this mixture. In most cases, however, it has been the practise to use a mixture of one part cement, to which can be added not over 10% hydrated lime, to three parts sand. This mixture insures a wall that is absolutely impervious.

It is a well known fact that shrinkage is the cause of the largest percentage of cracks in walls; it is also known that shrinkage is much greater the more water is added; and since the Cement Gun offers the opportunity of placing mortar with only the proper amount of water; by using the above precautions, and after determination as to which proportions of mortar mixture insures the best results in the climate considered, a wall can be produced which will not only be fire and damp proof, but also of indefinite life.



Gunite Over Brick. Field Columbian Museum



Gunite and Expanded Metal Over Tar Paper

An illustration of methods used in the case of larger panels in walls is that of the coal car thawing shed built for the P. and R. Railroad at Port Reading, N. J. This building is an all-steel frame, covered with Gunitite without and within; and in addition, the walls are provided with an inside coating wall which procured two air spaces for insulation. The columns are spaced about six feet apart connected only with tie rods. As a two faced wall was called for, it was necessary to shoot one side without the use of a panel. It was therefore decided to shoot the outer wall from the inside and against a panel. The reinforcing mesh was attached directly to the channels, the movable panel furried away the proper distance and the material shot on. The middle wall was built up by hanging a tar paper over the tie rods, which were on the center line of the channels. Over this a very light reinforcement was hung, and one-half inch of Gunitite shot on. The inner wall was built up by first attaching a reinforced tar paper (such as made by the Clinton Wire Cloth Company) directly to the columns, after which the reinforcing mesh was hung and then the Gunitite shot directly against the tar paper. In this way the double insulation was assured.



Gunitite Over Hollow Tile, Also Over Expanded Metal and Tar Paper

In shooting roofs, expansion joints may or may not be used. Experience has shown that long roofs have been shot without expansion joints and with perfect success, care being taken to see that the edges and valleys are doubly reinforced. In other cases however, expansion joints have been deemed necessary, in which case they can be made very successfully in the following manner: Stretch the reinforcing mesh in place over the rafters, taking care to see that this mesh is turned up vertically at the proposed joints. As roofs are usually shot from underneath, it will then be necessary to provide a square edge on the panel against which the shooting is done in order to cover this vertical wire. Prior to shooting the adjacent section, several layers of tar paper or felt are placed against these vertical joints thereby preserving a space between the two sections. This leaves a "Standing joint" which is then covered with a cap of some type (either reinforced Gunitite or metal).

The panels against which the material is shot from below usually consists of light boards which can be easily removed. This lower coat is shot only to such thickness as necessary to insure stability, when the finish coat is added from above.

These few suggestions are made with the view of aiding the readers to a solution of the various problems that confront them, and with the full knowledge that each case will be one that will be settled for itself, and on an enlargement of these ideas. We trust that all users of the Cement Gun will feel sufficiently interested in its use to aid others, by furnishing the company with a description of all special cases that may prove instructive.



Shooting Gunitite Over Expanded Metal

The following are some authoritative costs:

West New York Farms Company:

15 buildings—1478 square yards covered.

Labor	4.47	cents	per	sq.	yd.
Tending Cement Gun	3.70	"	"	"	"
Sundries	3.40	"	"	"	"
Repairs	2.60	"	"	"	"
Cement	13.77	"	"	"	"
Sand	7.81	"	"	"	"
	<hr/>				
	35.75	"	"	"	"
Mason	8.50	"	"	"	"
	<hr/>				
Total	44.25				

The authorities of the Whitby Hospital write: "Gunitite on exterior walls is done in two coats and has a total thickness of $\frac{3}{4}$ ". Nearly all this work is done from a swinging scaffolding and our cost per yard covers the raising, lowering, etc. of same. Our average cost for all outside Stucco done this season was 58 cts. per square yard. The first coat costs on an average of 49 cts. and the splash or finish costs 9 cts.

The wages we pay are as follows:—
Foreman 55 cts. Plasterers 50 cts. Nozzleman 50 cts. Unskilled labor 30 cts.

"You will note that the price per sq. yard is arrived at after all openings have been deducted. We believe it is customary on your side not to take openings into account at all, and of course this makes a considerable difference in the cost.

If openings are not deducted, then our average cost per square yard with openings deducted; if openings are not deducted, the work can be done for about 40c. The material costs the same as for Stucco and is applied by the same class of labour."

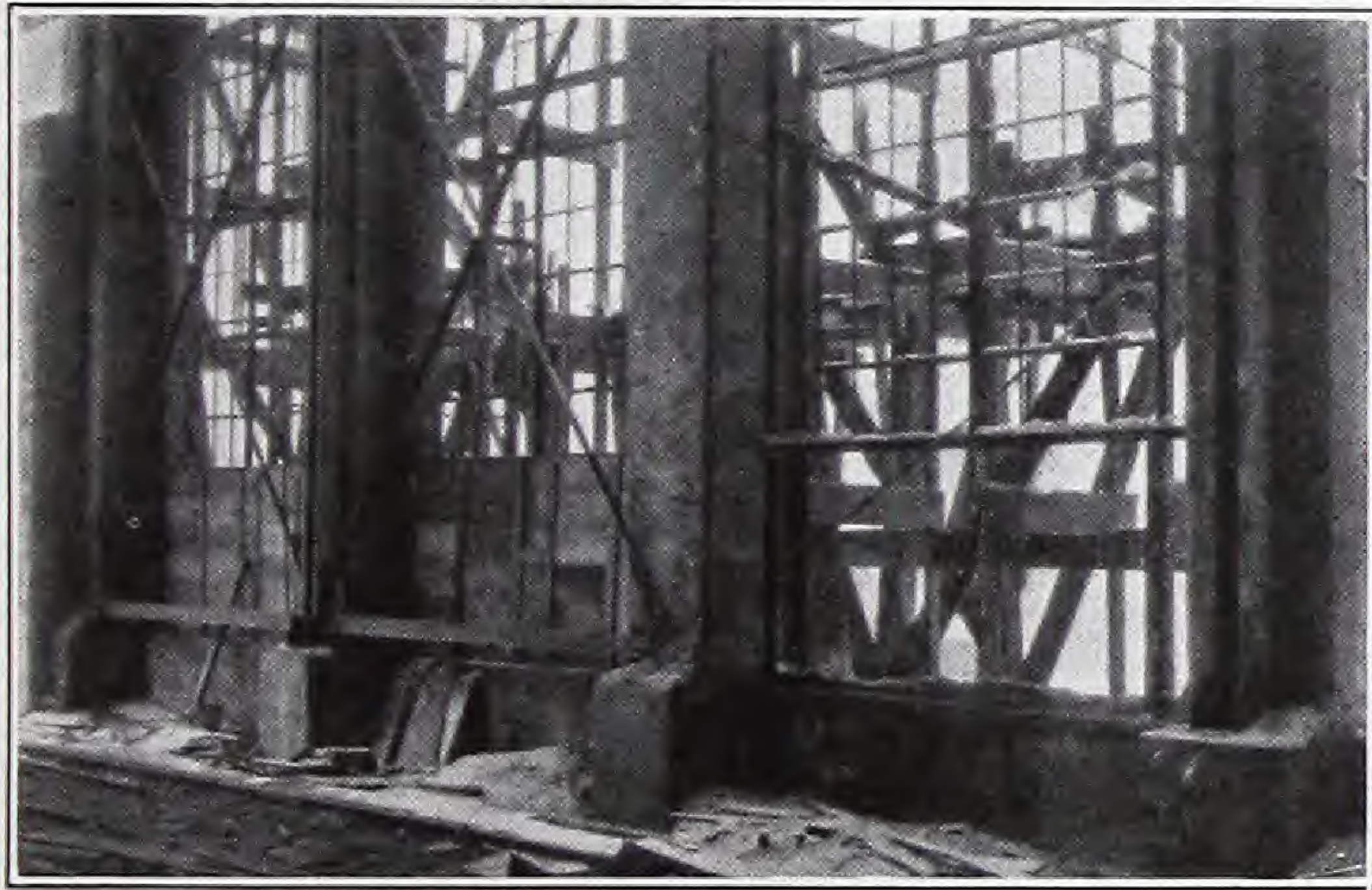
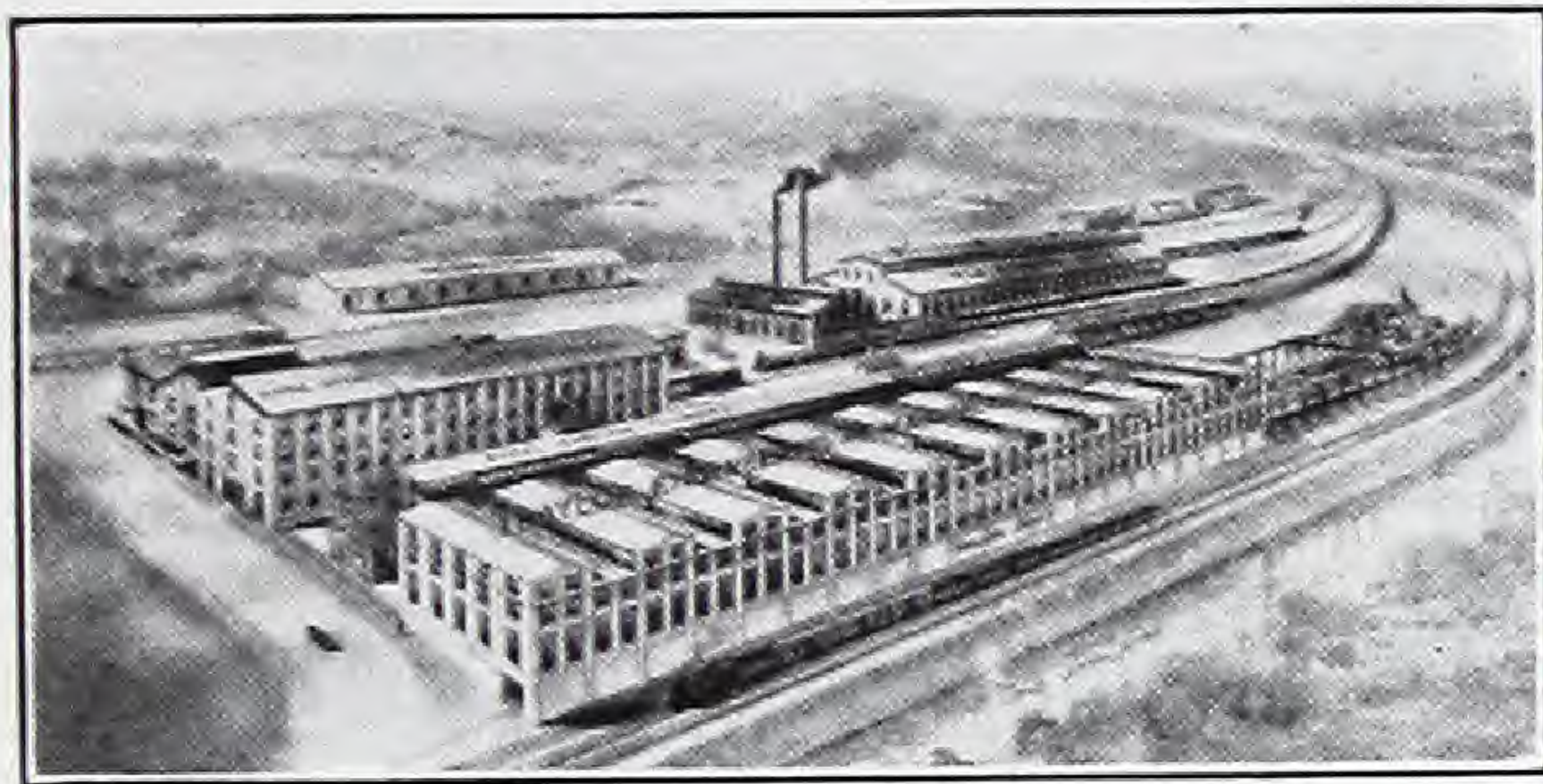


The great advantage of the use of Gunitite for buildings is due to the imperviousness of the mortor which is proven by the test bowls recently made and shown above.

Recently an N-1 Cement Gun covered 160 square feet of wall an inch thick in thirteen minutes, to illustrate the rapidity of operation of the machine.

Another illustration of how cheaply this work can be done was shown recently when a building containing 800 square yards was completely covered in two days.

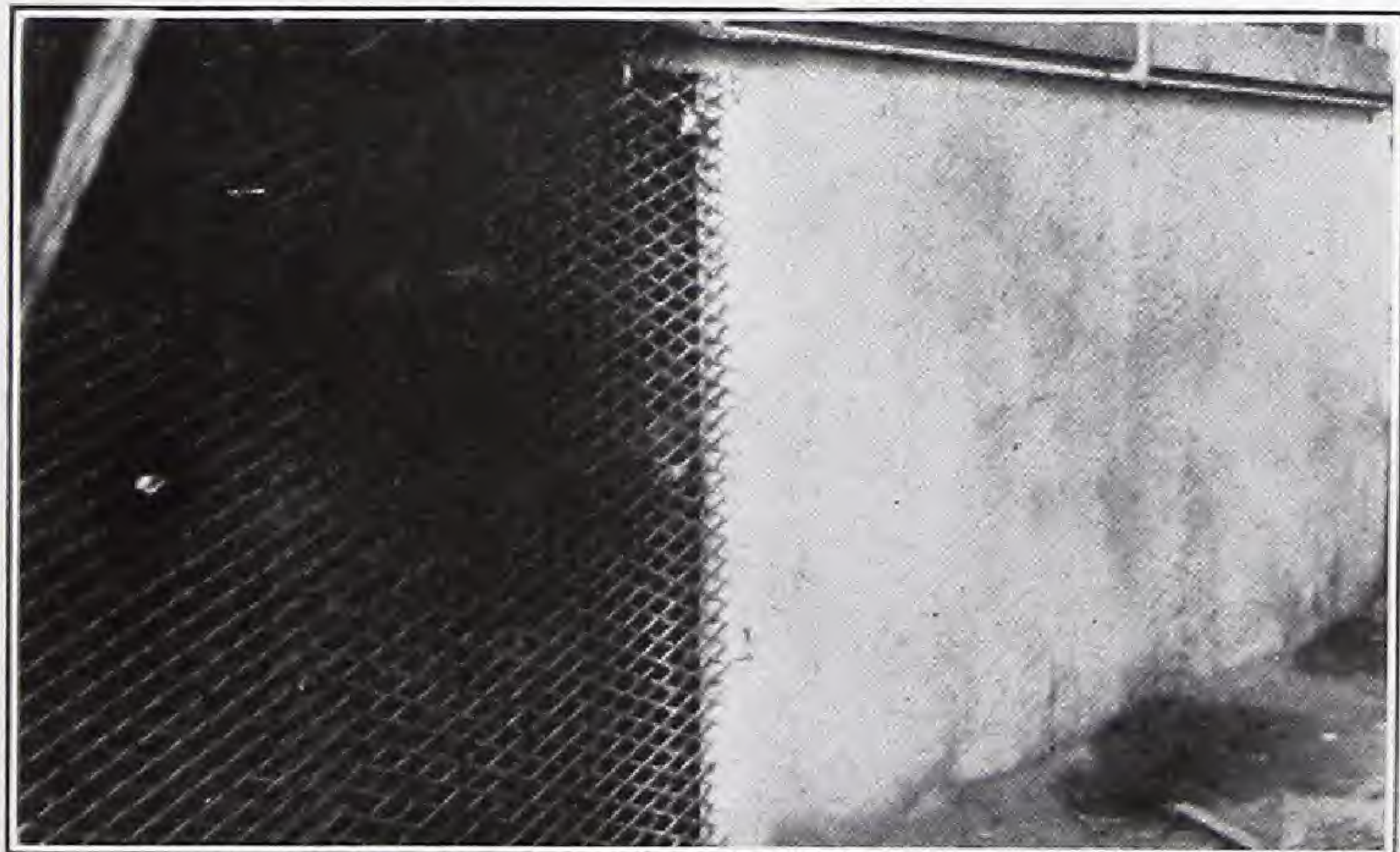
Bulletin No. 70 of the Bureau of Standards of the U. S. Government issued Jan. 31st 1917 compares the mortor obtained by the Cement Gun against hand placed stuccos. A building erected in October 1915 contains 57 panels, showing various stuccos over different substances. These panels were divided into groups. Group No. II consists of five panels, being made up of cement mortor over wire lath. Of these five, the four hand placed panels are rated in this report as "Poor" and "Very Poor," while the Cement Gun panel is rated as "Excellent."



Shops of the Traylor Engineering & Manufacturing Co., makers of Mining, Milling, and Crushing Machinery.

The building in the foreground is Gunitite over expanded metal.

Detail views of the Gunitite construction at the Traylor Engineering & Manufacturing Plant at Allentown, Pa.





Gunite and Expanded Metal Over Tar Paper



Gunite Over Brick

[BLANK PAGE]



CCA